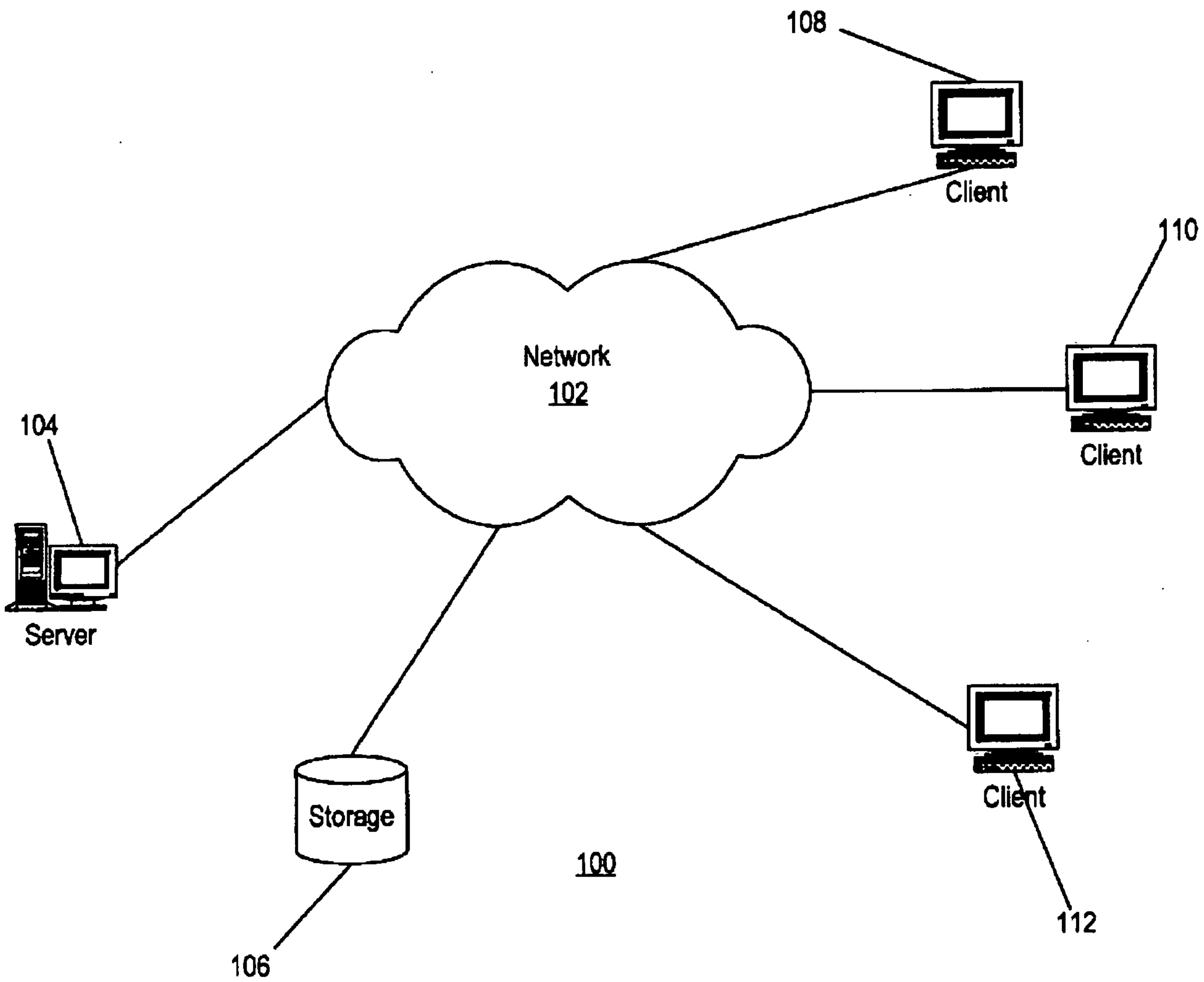
1/

EK190671357US

# Figure 1

AUS990853



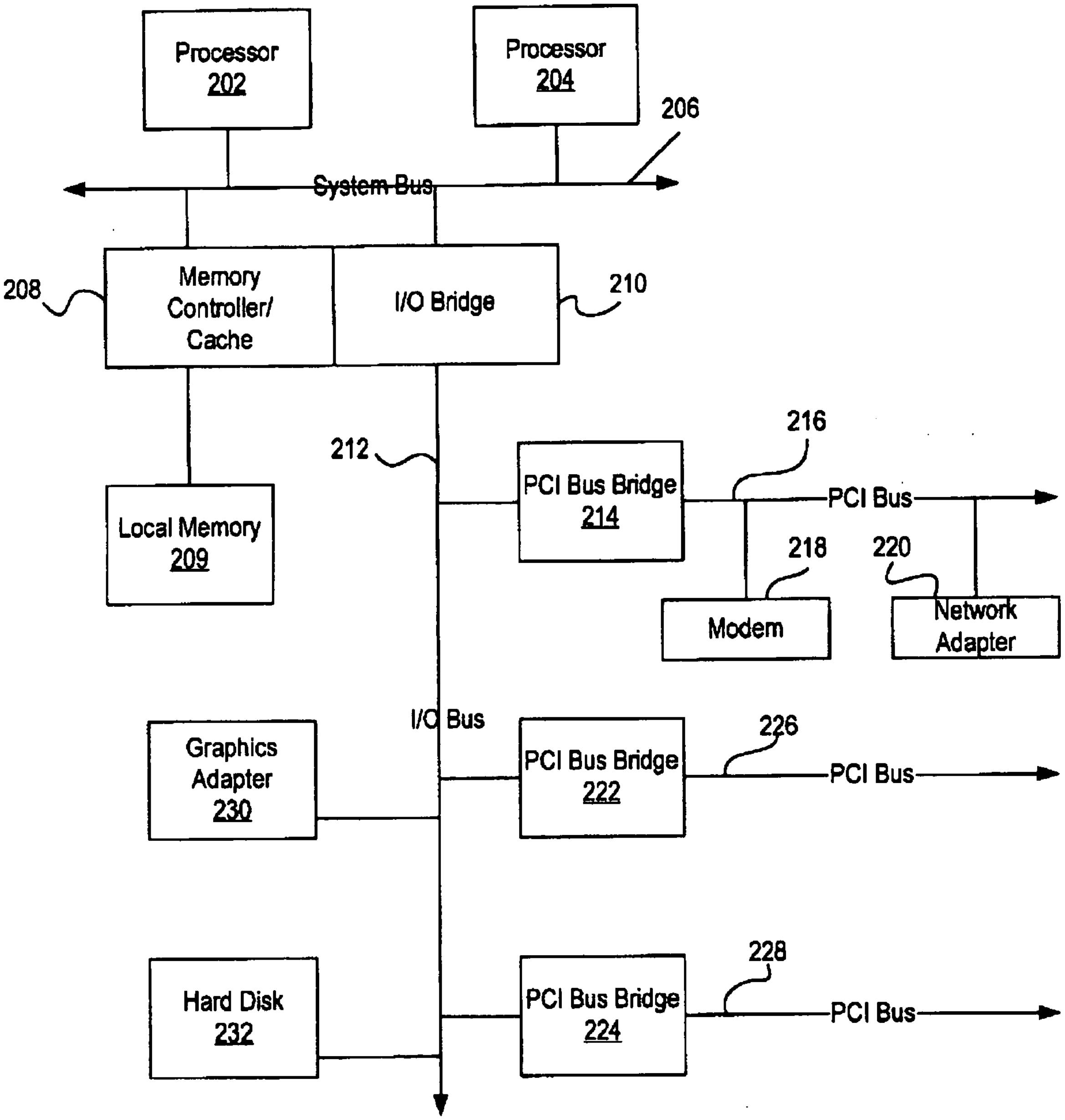
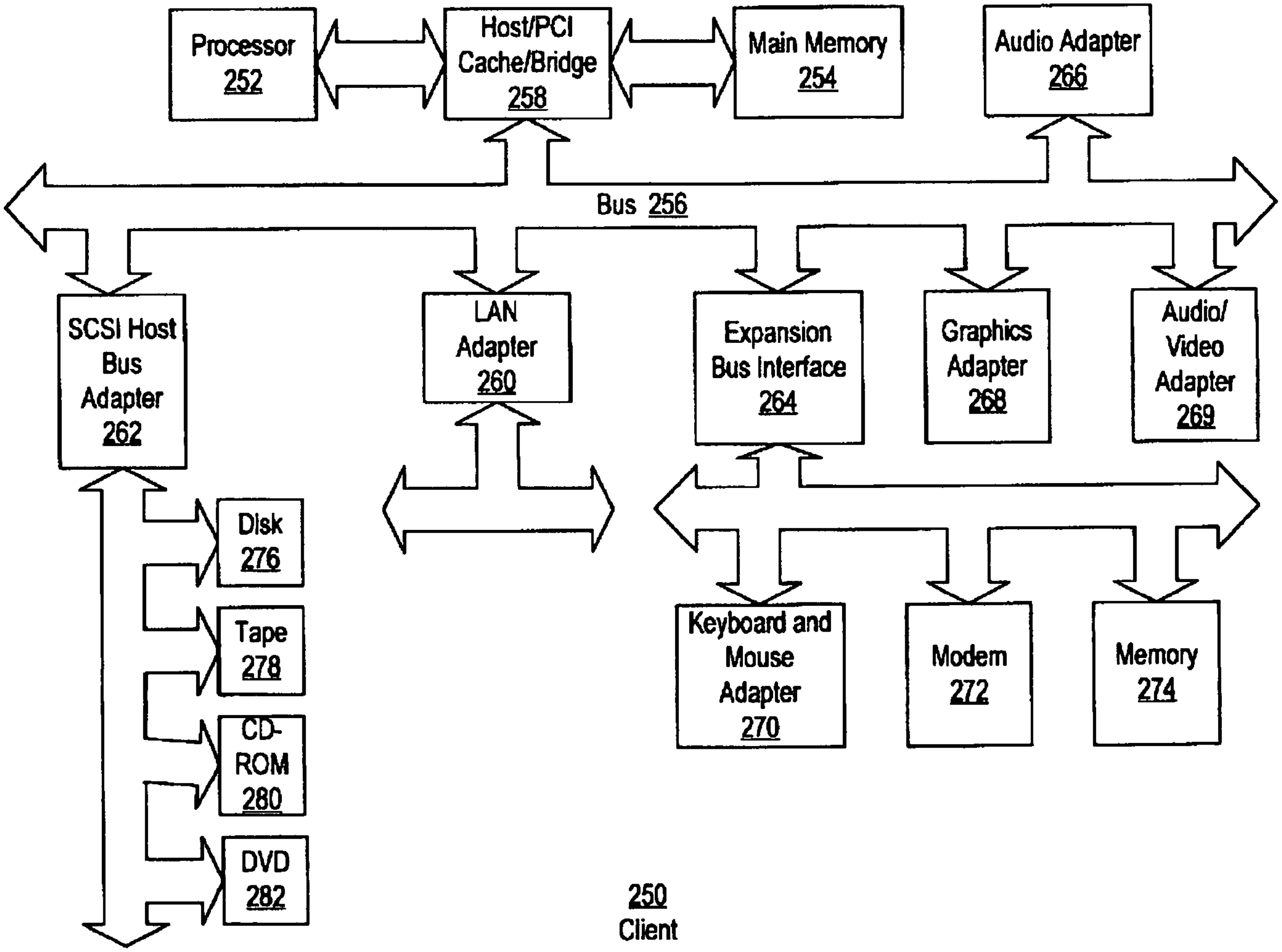


Figure 2A

AUS990853



250
Client

Figure 2B

AUS990853

Figure 3A
AUS990853

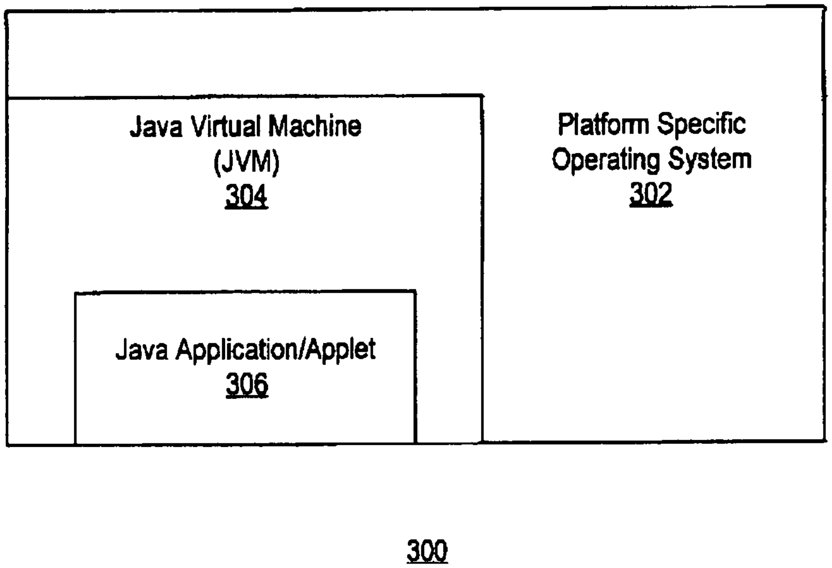


Figure 3B

AUS990853US1

350

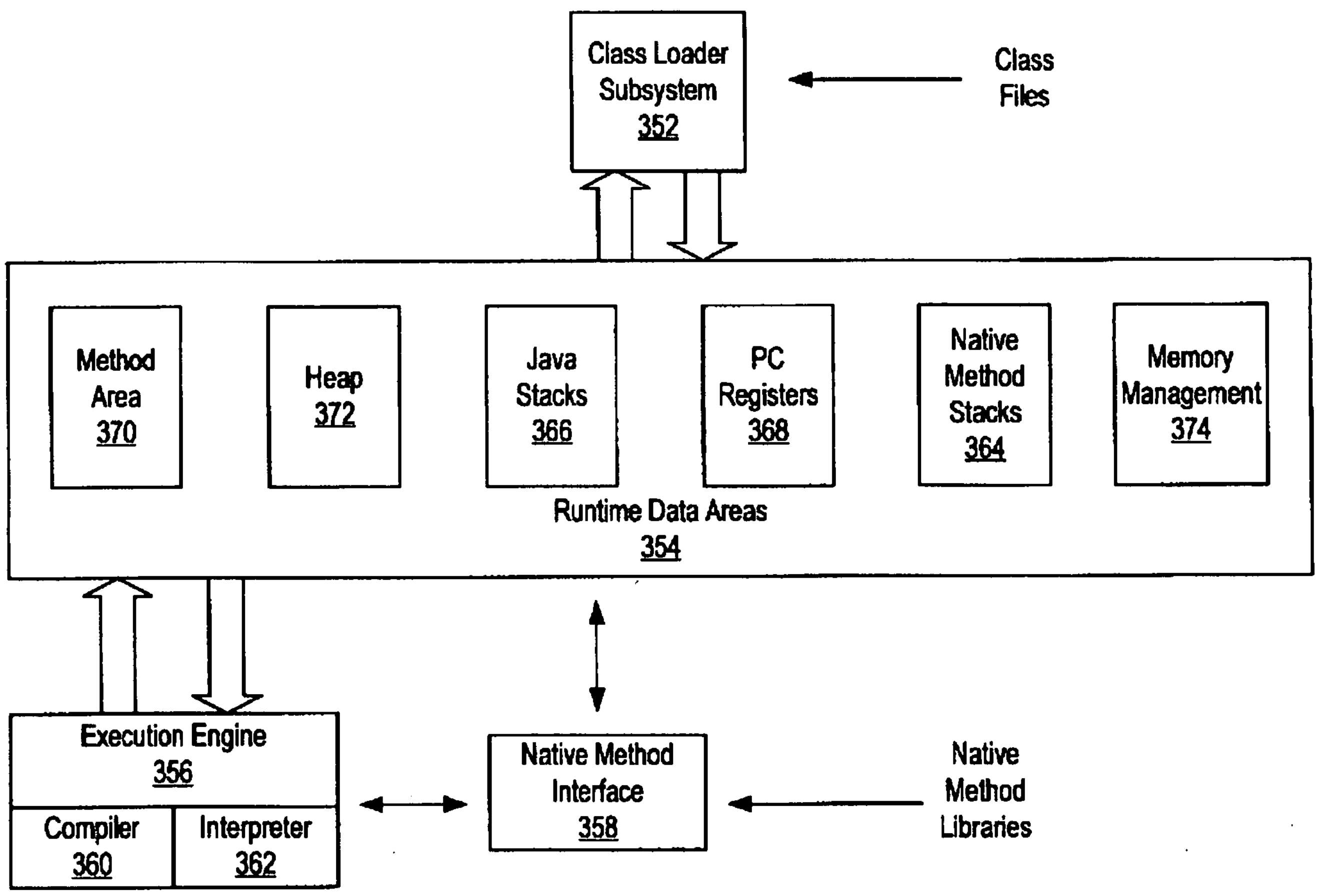
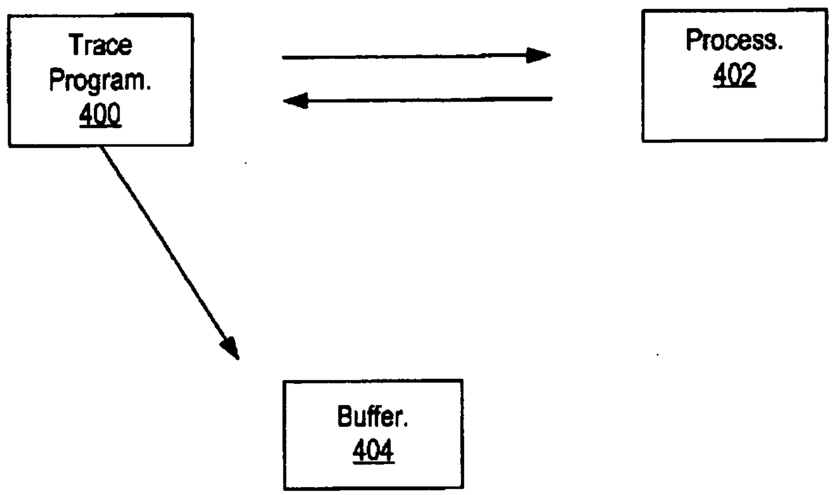


Figure 4

AUS990853



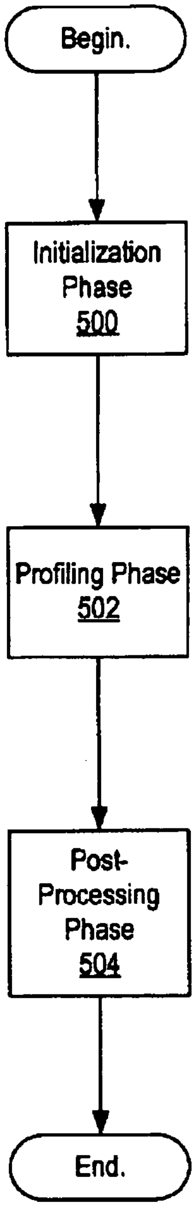
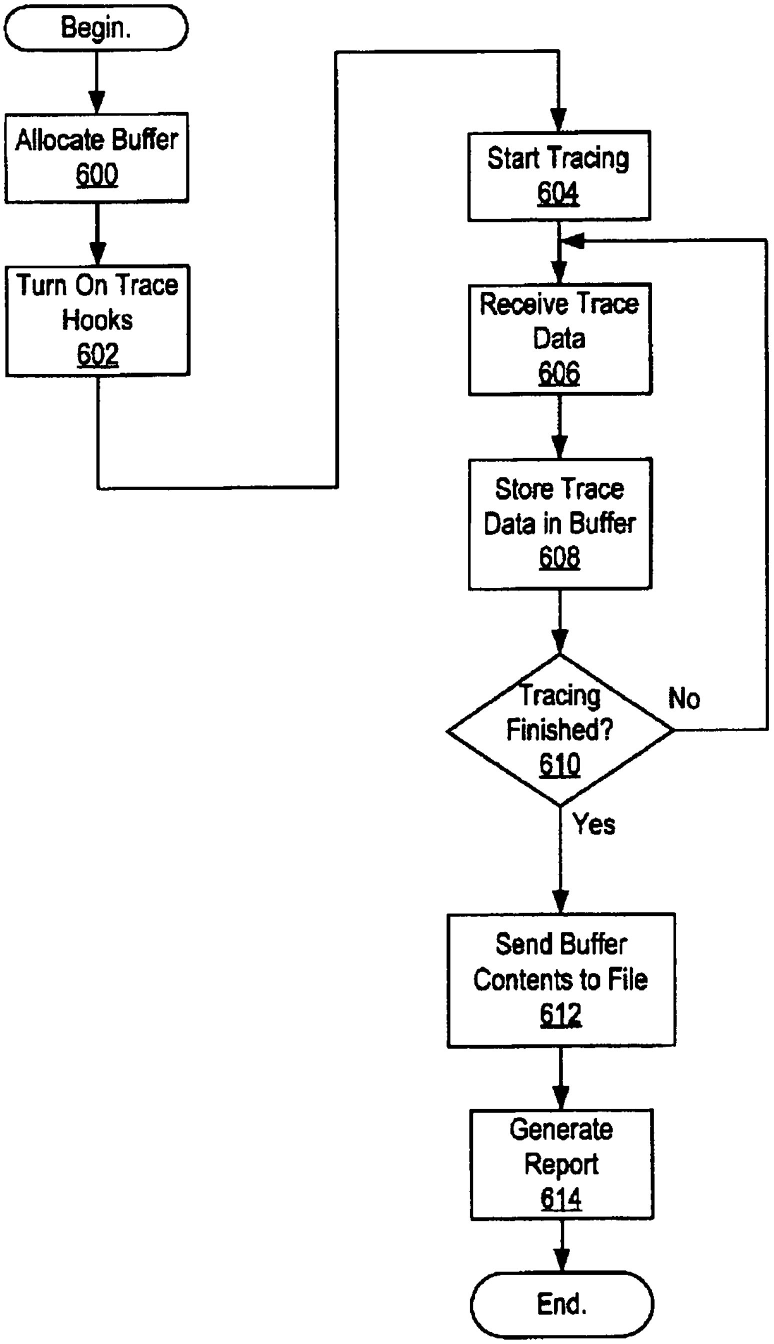


Figure 5

AUS990853US1

# Figure 6

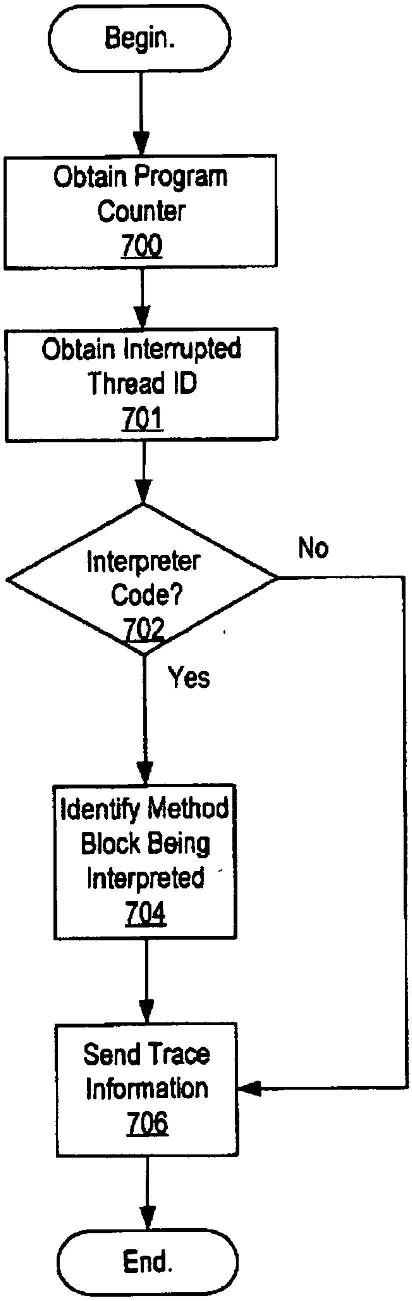
AUS990853



# Figure 7

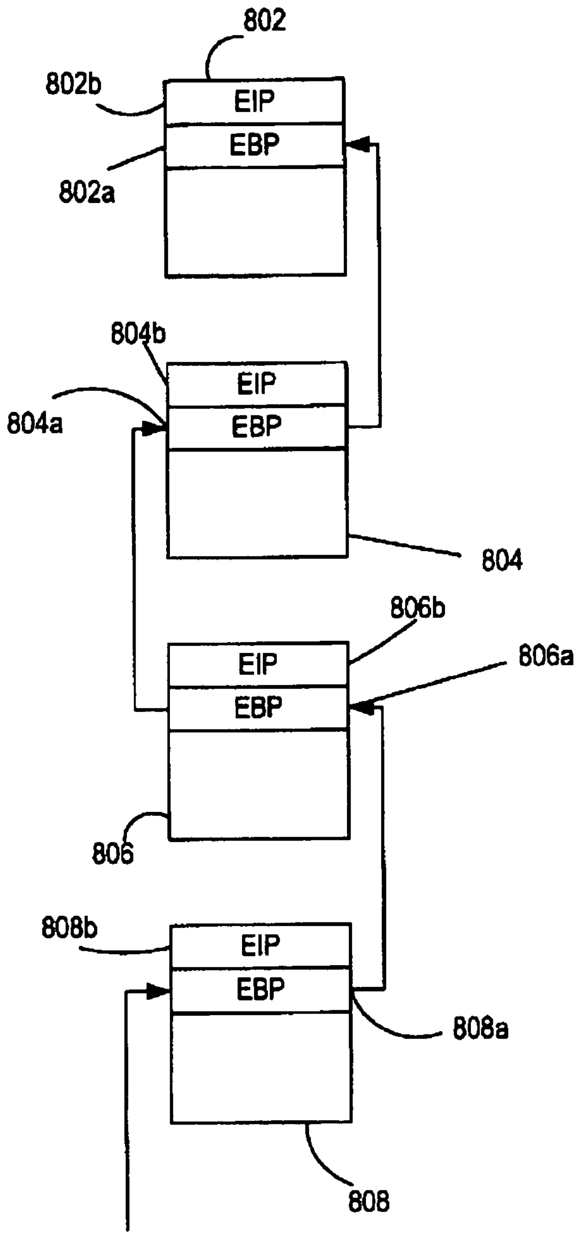
AUS990853

Interrupt Hook



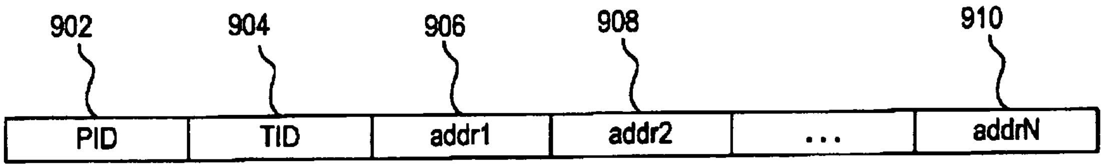
# Figure 8

AUS990853



# Figure 9

AUS990853



| Timestamp | Event | Call Stack After |
|---|---|---|
| 0 | enter C | Event |
| 1 | enter A | C |
| 2 | enter B | CA |
| 3 | exit from B | CAB |
| 4 | enter B | CA |
| 5 | enter B | CAB |
| 6 | exit from B | CABB |
| 7 | exit from B | CAB |
| 8 | exit from A | CA |
| 9 | enter B | C |
| 10 | enter A | CB |
| 11 | enter B | CBA |
| 12 | enter A | CBAB |
| 13 | exit from A | CBABA |
| 14 | exit from B | CBA |
| 15 | enter X | CBAX |
| 16 | exit from X | CBA |
| 17 | exit from A | CB |
| 18 | exit from B | C |
| 19 | exit from C | |

Figure 10A
AUS990853

| Sample | Call Stack @ Sample |
|---|---|
| 1 | C |
| 2 | CAB |
| 3 | CAB |
| 4 | CAB |
| 5 | C |
| 6 | CBA |
| 7 | CBABA |
| 8 | CBA |
| 9 | CBA |
| 10 | C |

Figure 10B
AUS990853

Figure 10C

AUS990853

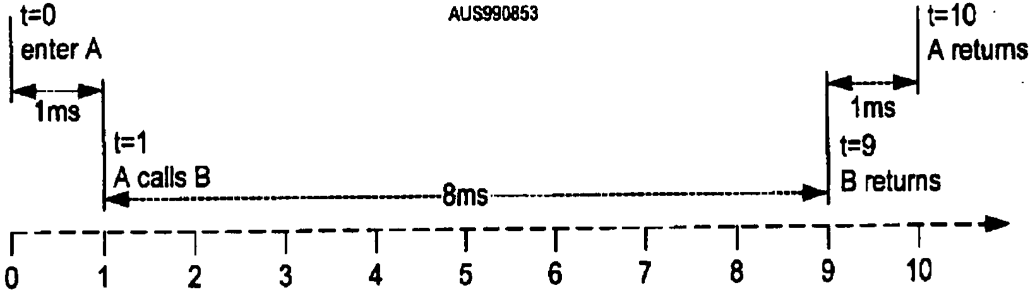


Figure 10D

AUS990853

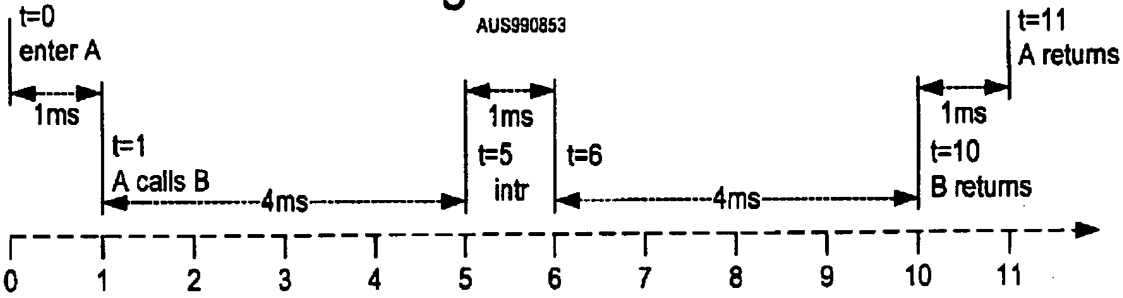
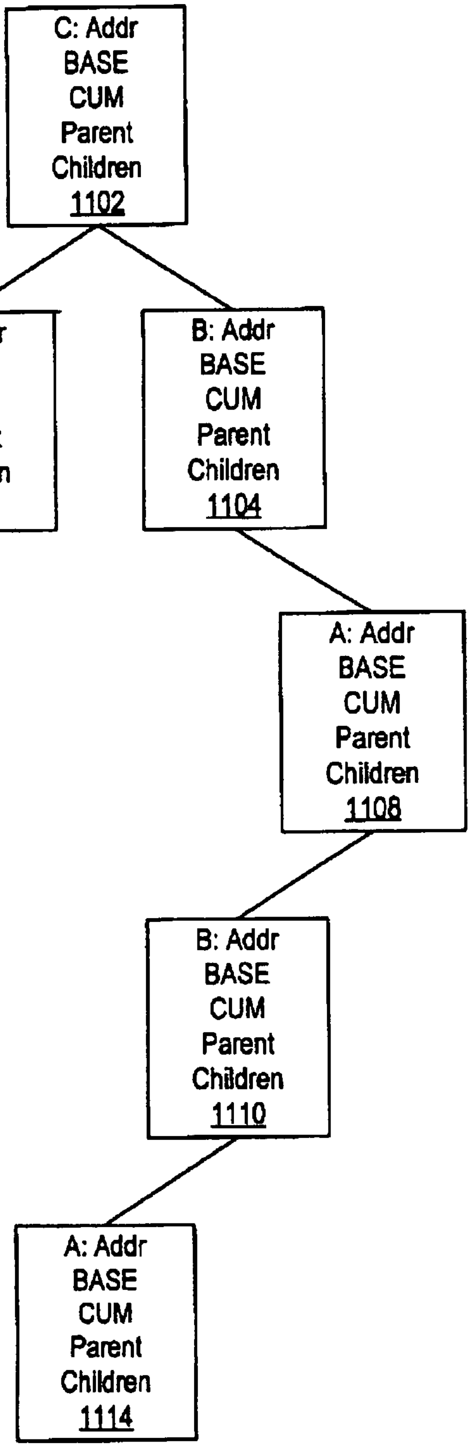


Figure 11A

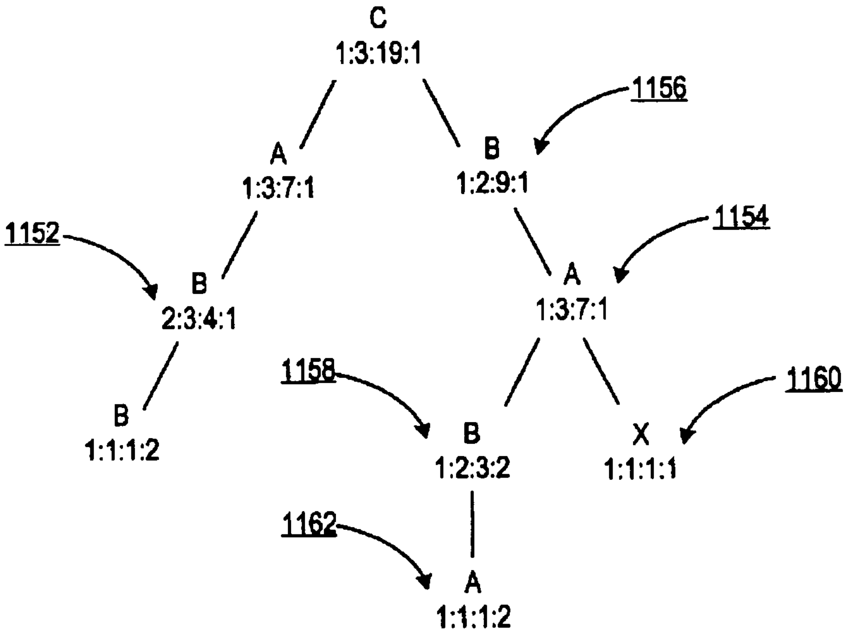
AUS990853

1100



# Figure 11B

AUS990853



# Figure 12

AUS990853

| Level 1230 | RL 1232 | Calls 1234 | Base 1236 | Cum 1238 | Indent 1240 |
|---|---|---|---|---|---|
| 0 | 1 | 1 | 0 | 19 | pt_pidtid |
| 1 | 1 | 1 | 3 | 19 | - C |
| 2 | 1 | 1 | 3 | 7 | - - A |
| 3 | 1 | 2 | 3 | 4 | - - - B |
| 4 | 2 | 1 | 1 | 1 | - - - - B |
| 2 | 1 | 1 | 2 | 9 | - - B |
| 3 | 1 | 1 | 3 | 7 | - - - A |
| 4 | 2 | 1 | 2 | 3 | - - - - B |
| 5 | 2 | 1 | 1 | 1 | - - - - - A |
| 4 | 1 | 1 | 1 | 1 | - - - - X |

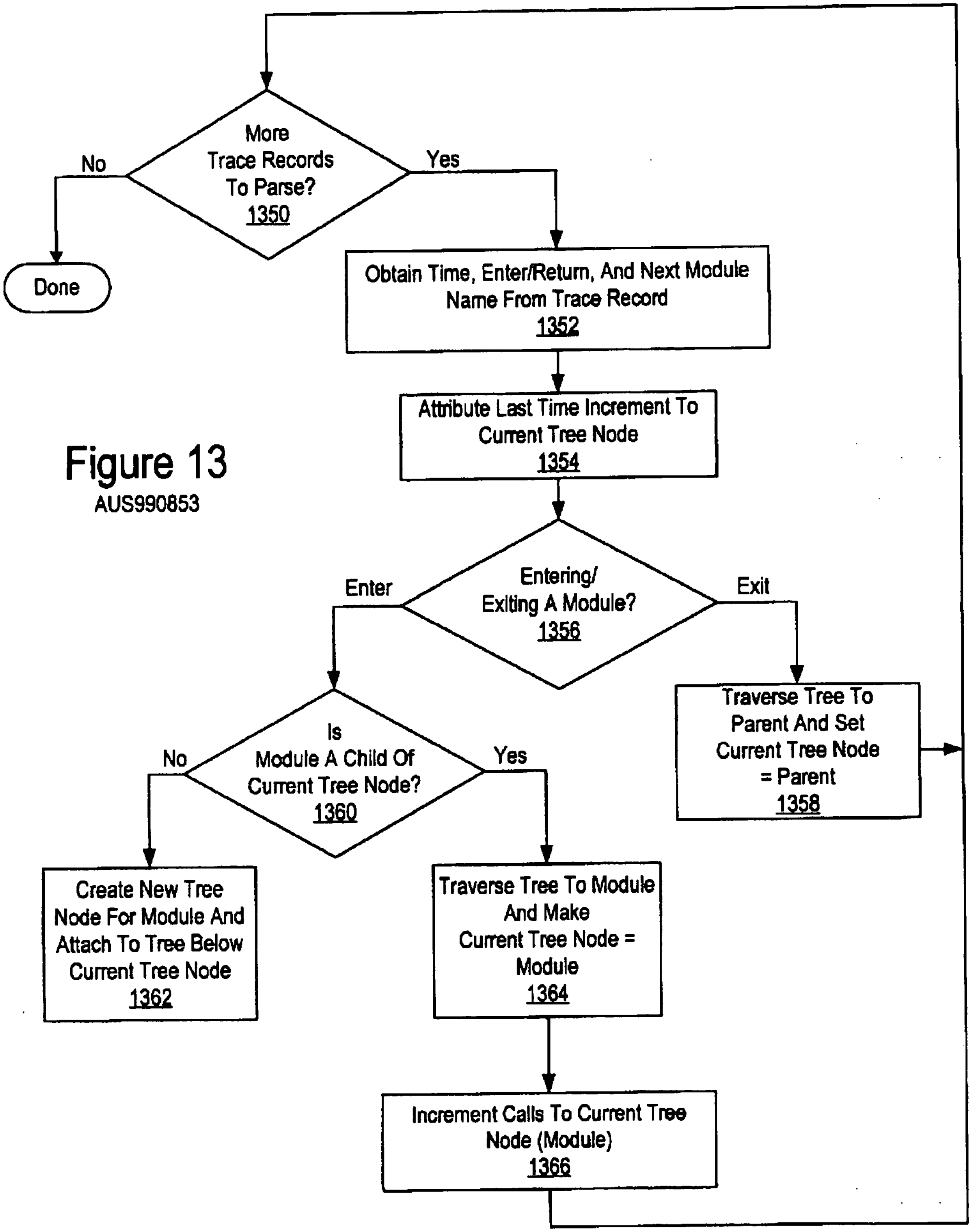
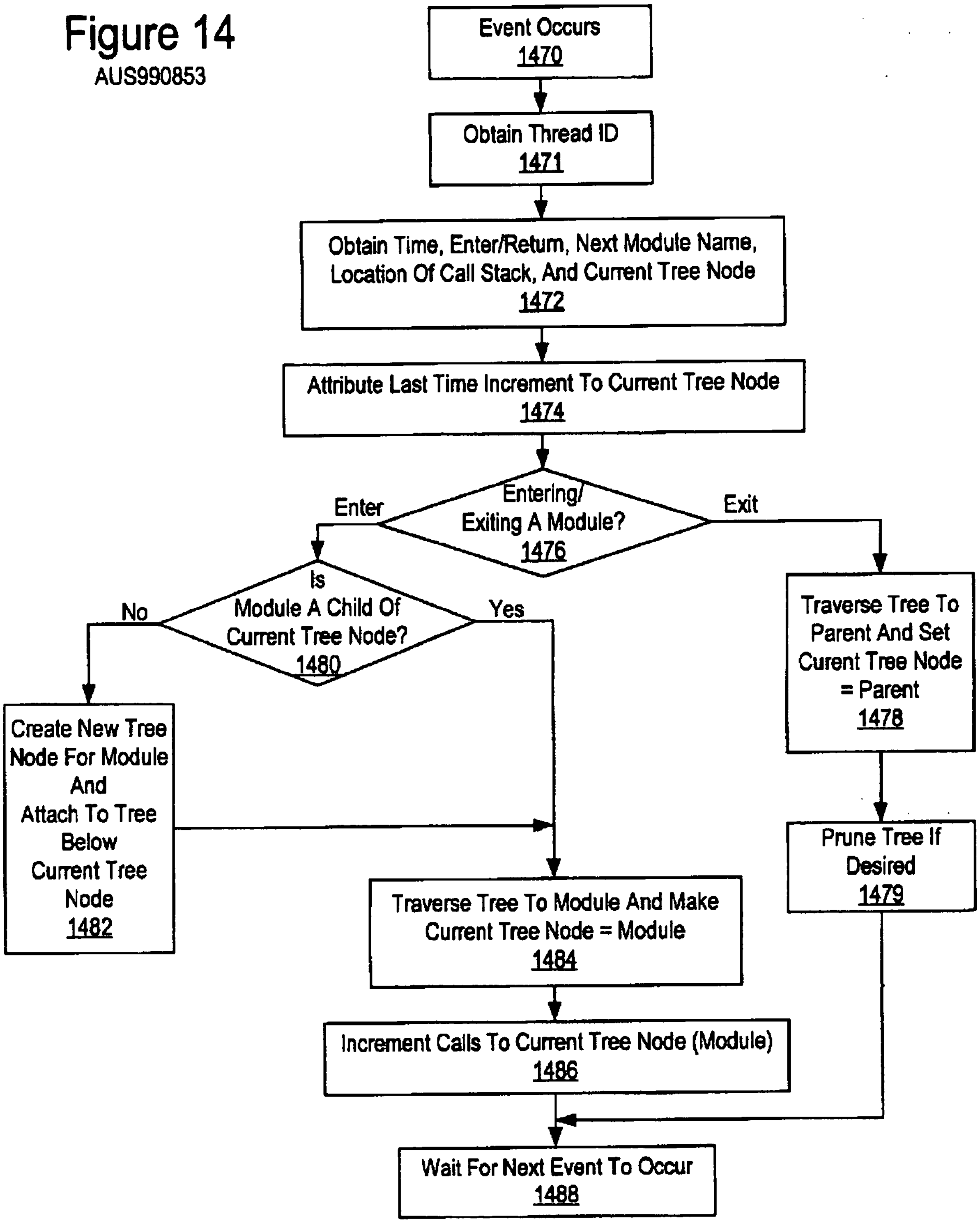


Figure 13
AUS990853

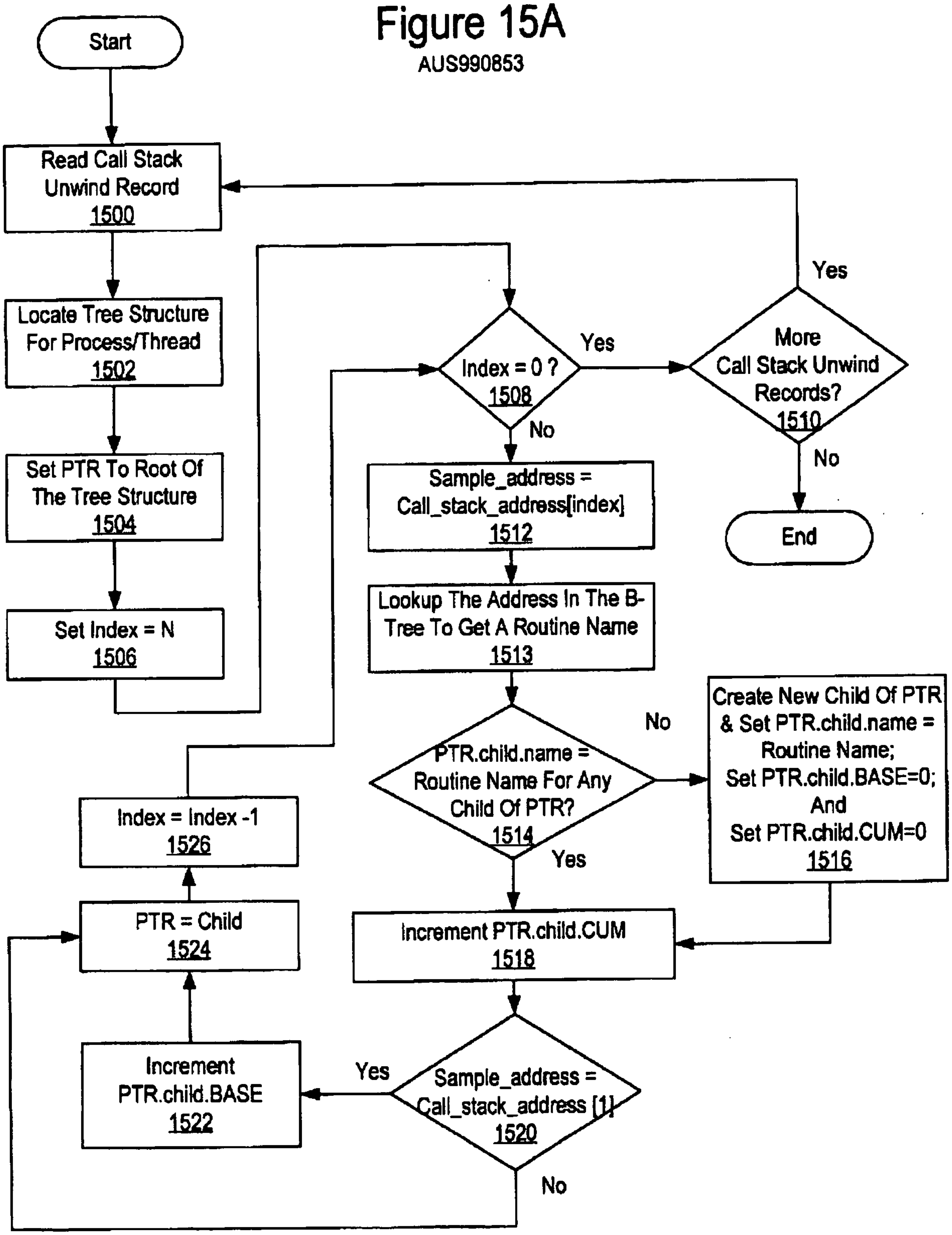
09612340.072600

Figure 14
AUS990853



# Figure 15A

AUS990853



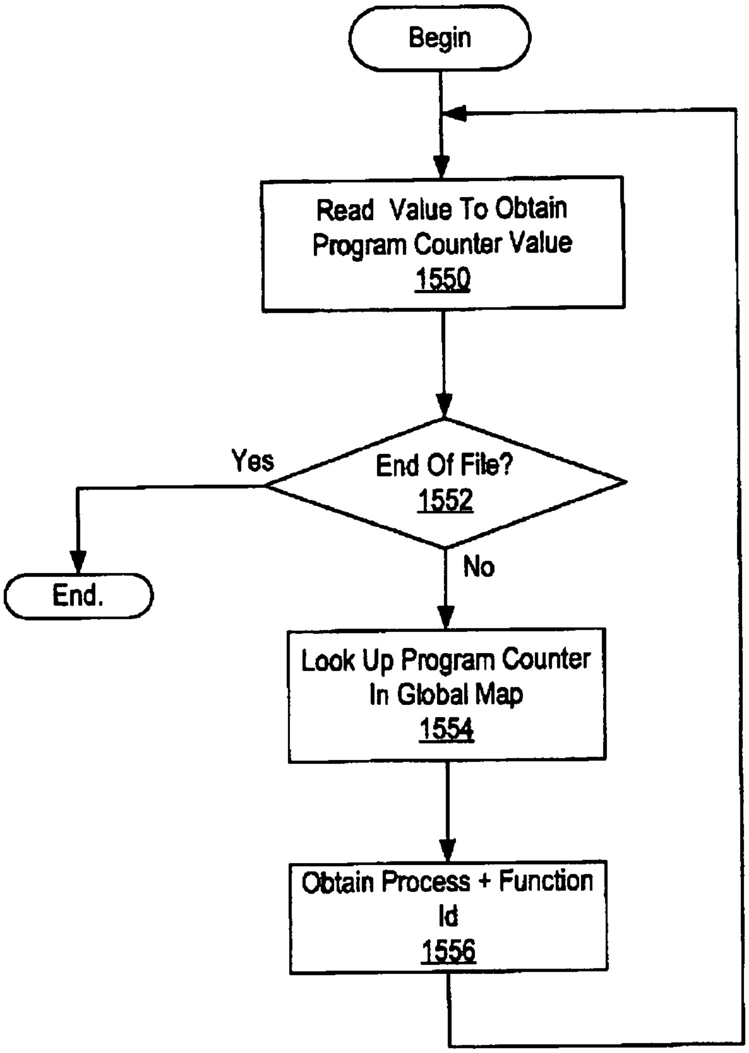


Figure 15B

AUS990853

# Figure 16

AUS990853

1600

| Calls 1602 | Base 1604 | Cum 1606 | Name 1608 |
|---|---|---|---|
| 1 | 0 | 19 | pt_pit.tid |
| 1 | 3 | 19 | C |
| 3 | 7 | 14 | A |
| 5 | 8 | 13 | B |
| 1 | 1 | 1 | X |

# Figure 17

AUS990853

1700

ArcFlow Output

Base - Time/Instructions directly in function

Cum - Time/Instructions directly & indirestly in function

ArcFlow Invarients:

1) Sum(Parent(Calls)) = Self(Calls)
2) Sum(Parent(Base)) = Self(Base)
3) Sum(Parent(Cum)) = Self(Cum)
4) Sum(Child(Cum)) = Self(Cum) - Self(Base)

| Source | Calls | Base | Cum | Function |
|---|---|---|---|---|
| Self | 1 | 0 | 19 | [0] pt_pidtid |
| Child | 1 | 3 | 19 | C |
| Parent | 1 | 3 | 19 | pt_pidtid |
| Self | 1 | 3 | 19 | [1] C |
| Child | 1 | 2 | 9 | B |
| Child | 1 | 3 | 7 | A |
| Parent | 1 | 3 | 7 | C |
| Parent | 1 | 3 | 7 | B |
| rParent | 1 | 1 | 1 | B |
| Self | 3 | 7 | 17<br>15 | [2] A |
| Child | 3 | 5 | 7 | B |
| Child | 1 | 1 | 1 | X |
| Parent | 2 | 3 | 4 | A |
| rParent | 1 | 2 | 3 | A |
| Parent | 1 | 2 | 9 | C |
| Self | 5 | 8 | 13<br>17 | [3] B |
| Child | 1 | 3 | 7 | A |
| rChild | 1 | 1 | 1 | A |
| Child | 1 | 1 | 1 | B |
| Parent | 1 | 1 | 1 | A |
| Self | 1 | 1 | 1 | [4] X |

# Figure 18

AUS990853

1800

```
Units :: Ticks
Total ::      342


LvL RL Calls  Base   Cum  Indent Name
  1  1      1     0   342 - _Thread-21__(0xe0046618)
  2  1      3     0   342 – J:nulltestScore()I
  3  1      2     0   272 — J:nulltestMilliseconds(I)I
  4  1  29450     0   271 — J:nullexecute()I
  5  1    271     0   271 —+ stack_0x40
  6  1    271     0   271 —+- F:ExecuteJava———————————————— 1802
  7  1    271     0   271 —+– F:jit_invokeCompiledEntryMethod
  8  1    271     0   271 —+— F:_jit_invokeentry
  9  1    271     0   271 —+—  F:JITInvokeCompiledEntryMethod_md
 10  1    271     0   271 —+—+ J:nullrun()V
 11  2    271     0   271 —+—+- J:nulltestScore()I
 12  2    271     0   271 —+—+– J:nulltestMilliseconds(I)I                1806
 13  2    271   268   271 —+—+— J:nullexecute()I
 14  1      2     0     2 —+—+—  F:jperf_methodEntry
 15  1      2     0     2 —+—+—+ F:SoftTracehook
 16  1      2     2     2 —+—+—+- F:enable_interrupts
 14  1      1     1     1 —+—+—  F:jperf_methodExit
  4  1      1     0     1 — stack_0x40
  5  1      1     0     1 —+ F:ExecuteJava—————————————————— 1804
  6  1      1     0     1 —+- F:jit_invokeCompiledEntryMethod
  7  1      1     0     1 —+– F:_jit_invokeentry
  8  1      1     0     1 —+— F:JITInvokeCompiledEntryMethod_md
  9  1      1     0     1 —+— J:nullrun()V
 10  2      1     0     1 —+—+ J:nulltestScore()I
 11  2      1     0     1 —+—+- J:nulltestMilliseconds(I)I                1808
 12  1      1     0     1 —+—+– J:nullexecute()I
 13  1      1     0     1 —+—+— F:jperf_methodExit
 14  1      1     0     1 —+—+—  F:SoftTracehook
 15  1      1     1     1 —+—+—+ F:enable_interrupts
  4  1      2     0     0 — J:nullcleanUp()I
```

# Figure 19

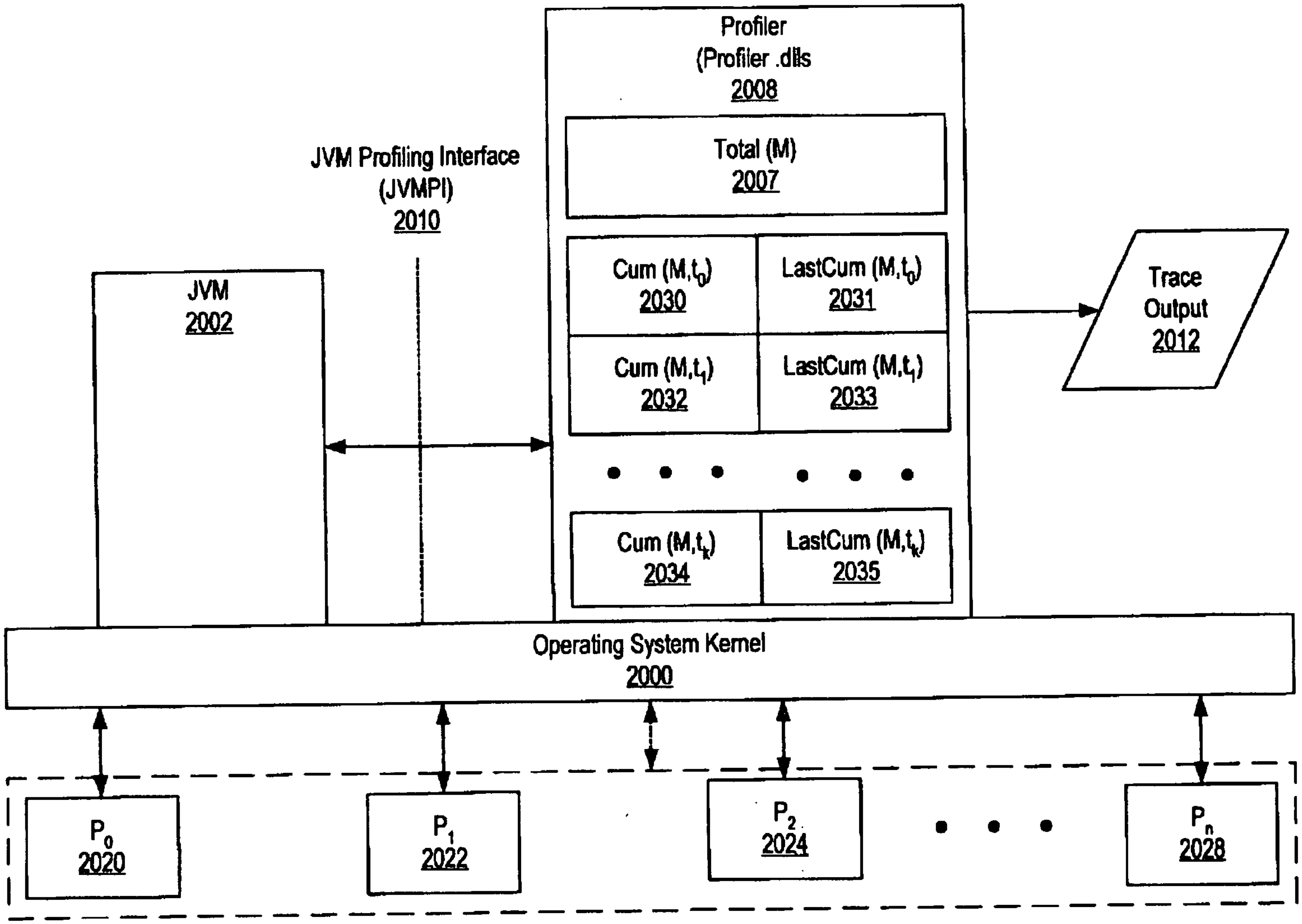
AUS990853

| Major Code | Minor Code | Data Item 1 | Data Item 2 | Data Item 3 | Data Item 4 | Data Item 5 | Description |
|---|---|---|---|---|---|---|---|
| 0x4 | level + 0x1 | depth | n/a | n/a | n/a | | begin interrupt at level |
| 0x4 | level + 0x80000001 | depth | n/a | n/a | n/a | | end interrupt at level |
| 0x10 | 0xab | system tid | java tid | is System Thread (boolean) | n/a | | thread created without a name while trace active |
| 0x10 | 0xac | system tid | n/a | n/a | n/a | | identifies the idle thread |
| 0x10 | 0xad | system tid | n/a | n/a | n/a | | identifies the garbage collection thread |
| 0x10 | 0xae | system tid | java tid | thread name | n/a | | thread created with a name while trace active |
| 0x30 | 0x10 | object id | method block address | n/a | n/a | | method invocation (interpreted) |
| 0x30 | 0x10 + 0x80000000 | object id | method block address | n/a | n/a | | method exit (interpreted) |
| 0x40 | 0x7fffffff | number (n) of stack unwinds at timer interrupt | pc1-program counter of interrupted routine | pc2-caller of interrupted routine | ....... | pcn-1 of n-2nd caller of interrupted routine | pcn of n-1st caller of interrupted routine |
| 0x41 | 0x7fffffff | number (n) of stack unwinds at instrumented routine | pc1-program counter of instrumented routine | pc2-caller of instrumented routine | ....... | | pcn of n-1st caller of instrumented routine |
| 0x50 | 0x10 | object id | method block address | n/a | n/a | | method invocation (jitted) |
| 0x50 | 0x10 + 0x80000000 | object id | method block address | n/a | n/a | | method exit (jitted) |

# Figure 20

AUS990853

Application Level Thread Oriented Approach

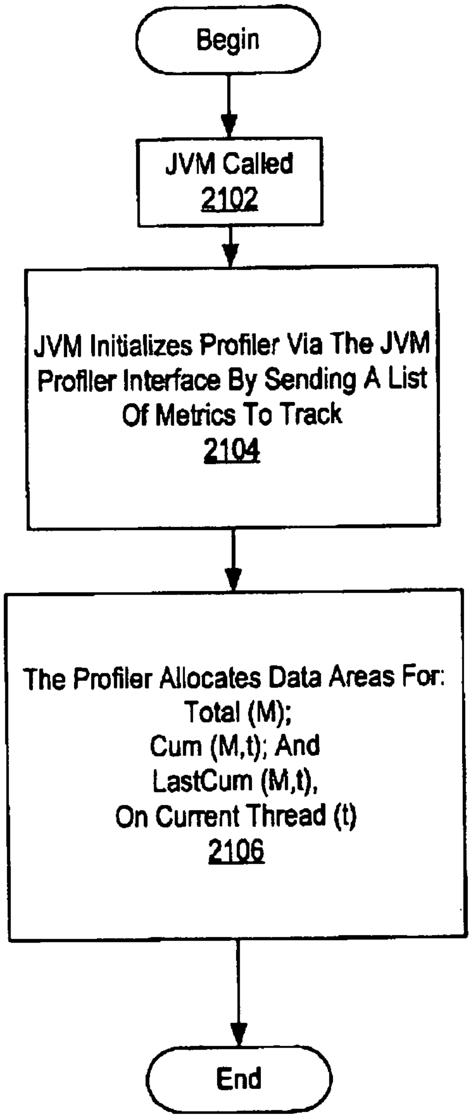


## Figure 21A

AUS990853

Application Level

Thread Oriented Approach



## Figure 21B

AUS990853

Application Level

Thread Oriented Approach for Each New Thread

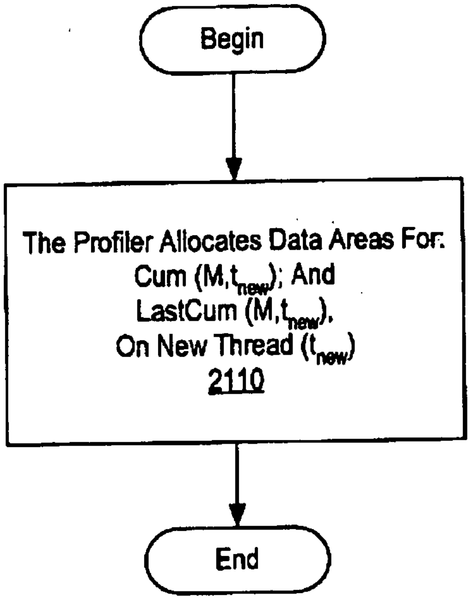
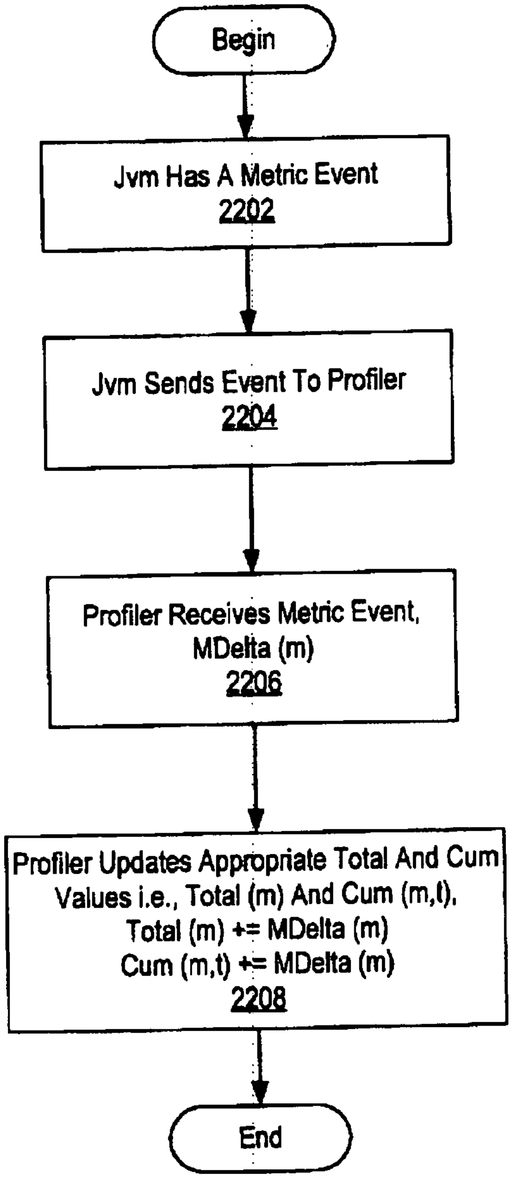


Figure 22

AUS990853

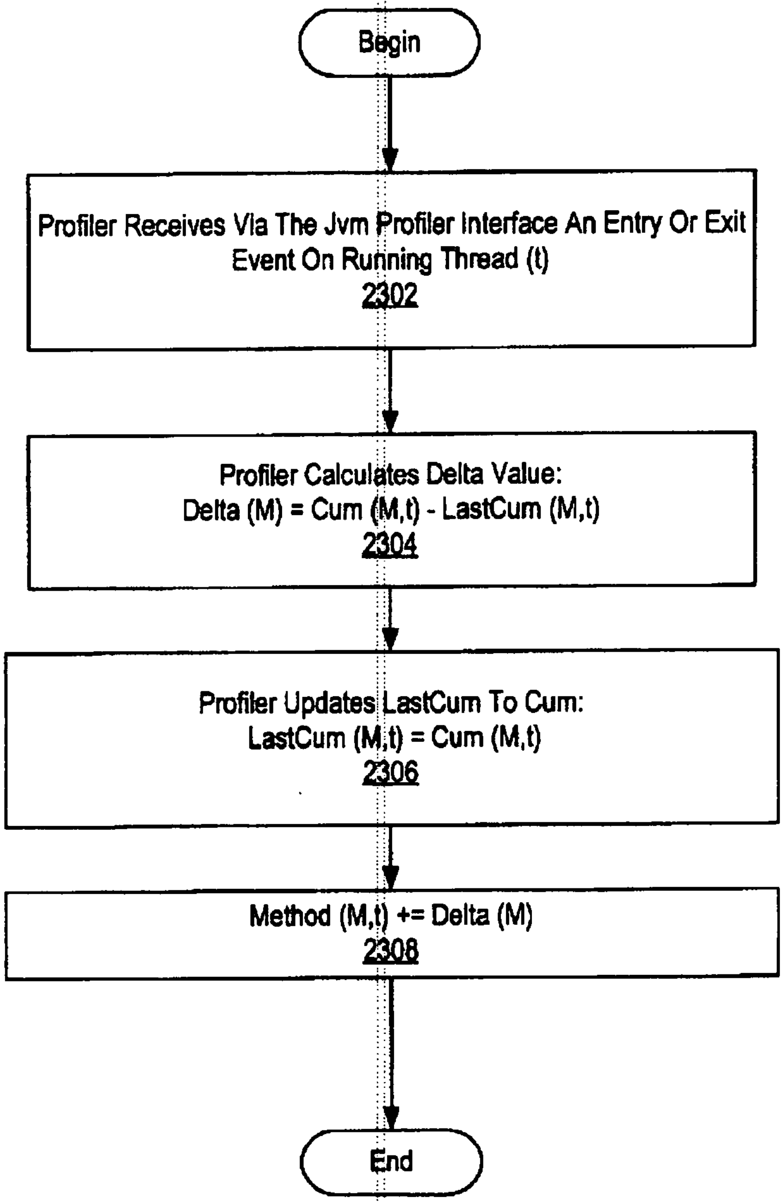
Profiler Receives Metric Event from Jvm



# Figure 23

AUS990853

Application Level Thread Oriented Approach



# Figure 24

AUS990853

API for Metric Values

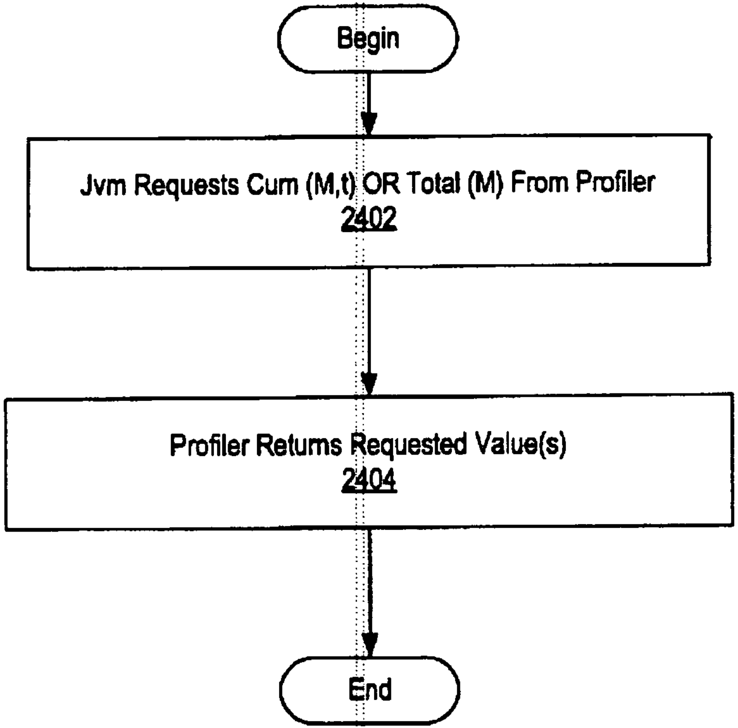
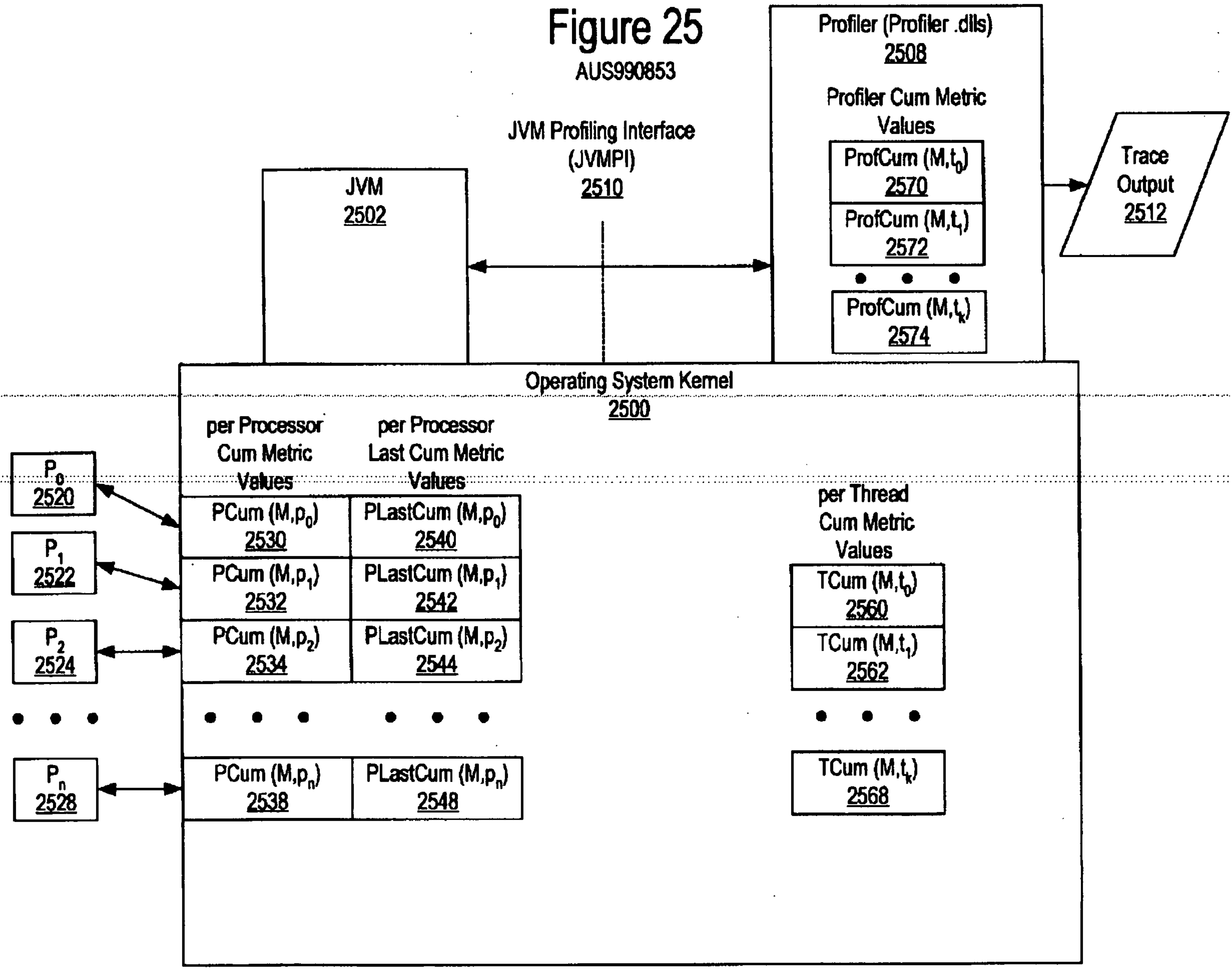


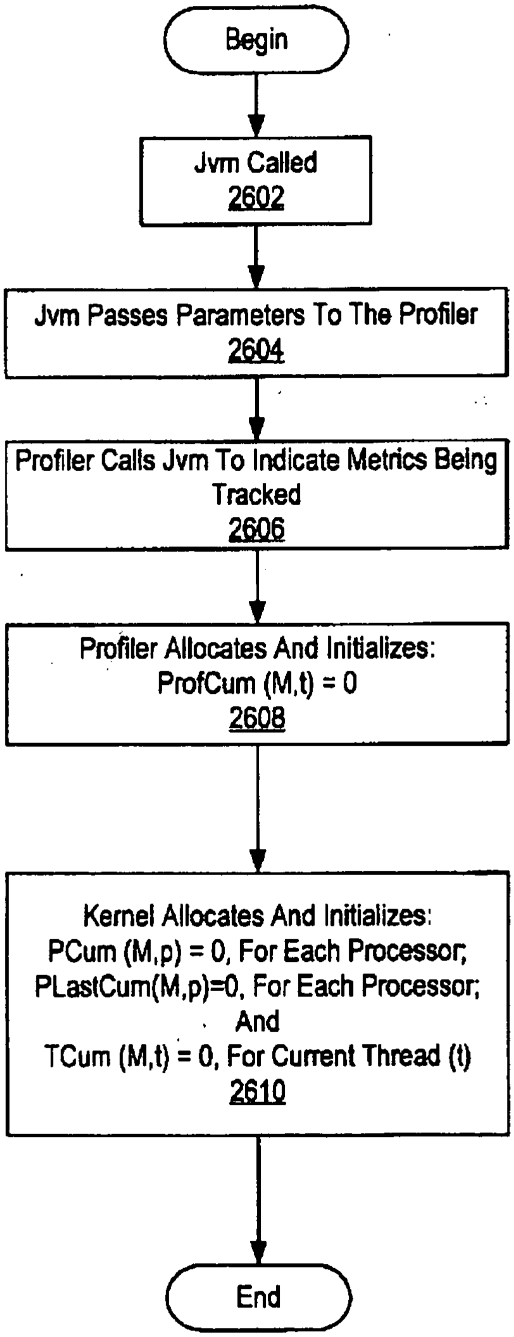
Figure 25
AUS990853



## Figure 26A

AUS990853

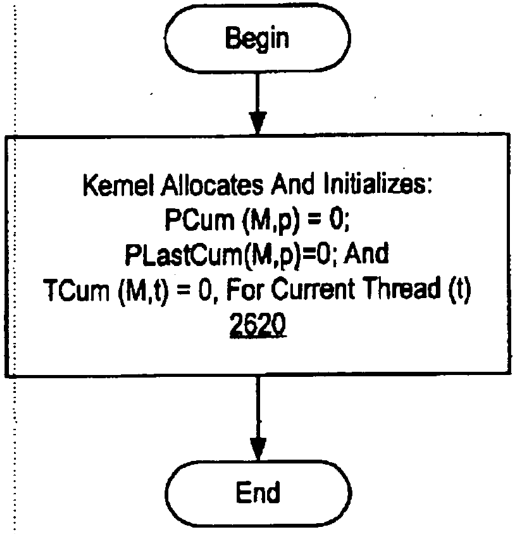
Initialization Process



## Figure 26B

AUS990853

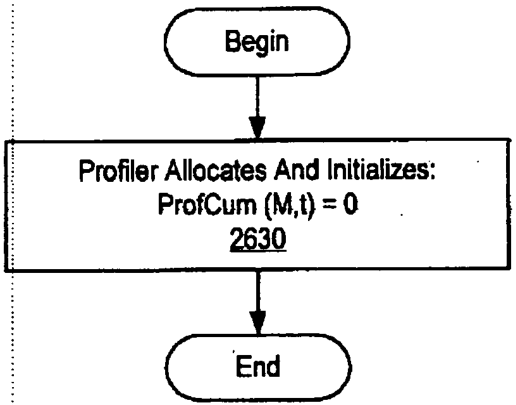
Process for the Kernel Recognizing a New Thread on Processor (p)



## Figure 26C

AUS990853

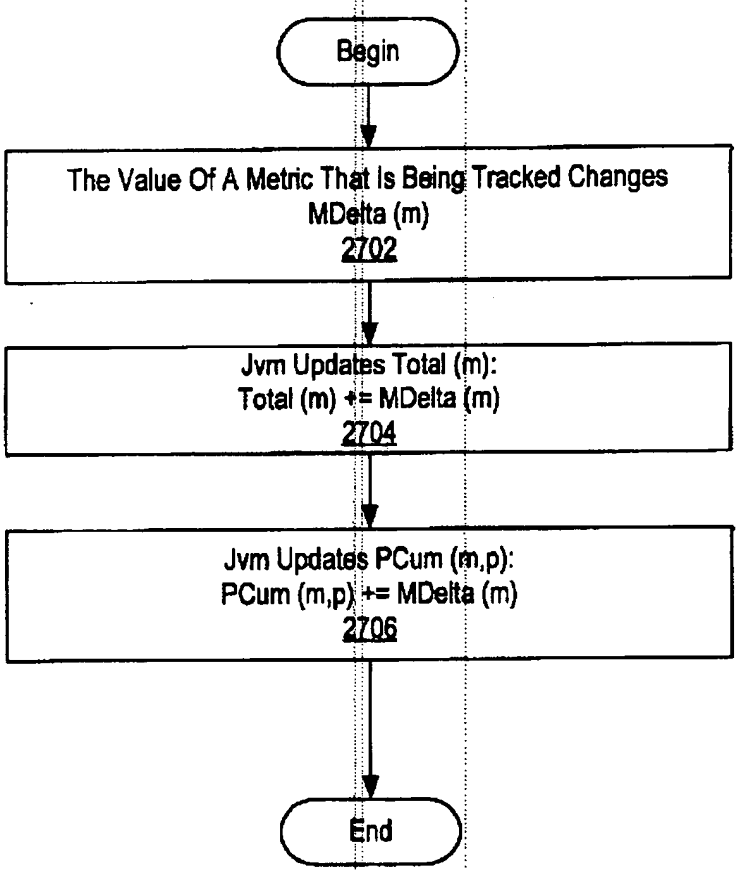
Process for the Profiler Recognizing a New Thread



# Figure 27

AUS990853

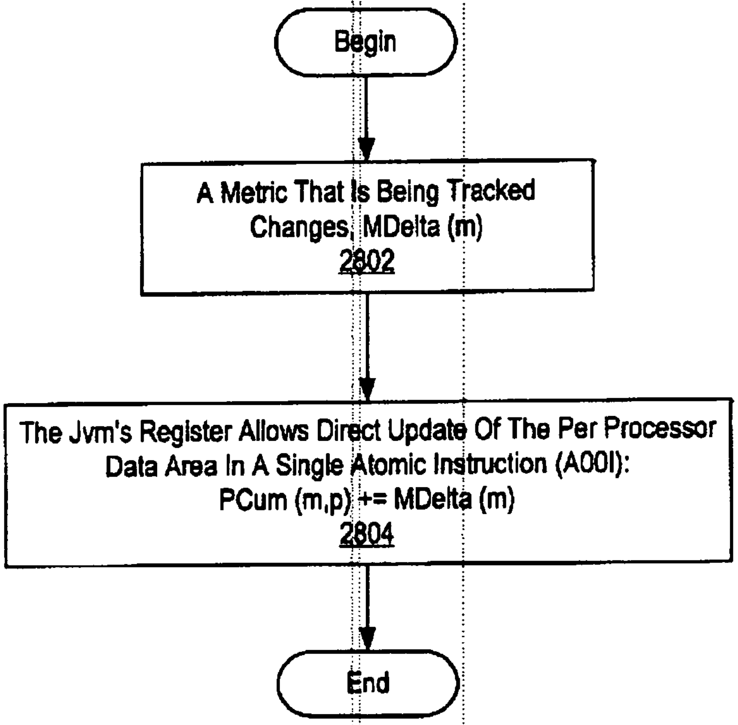
## Jvm Process for Updating Variable Values for Metrics Being Tracked



# Figure 28

AUS990853

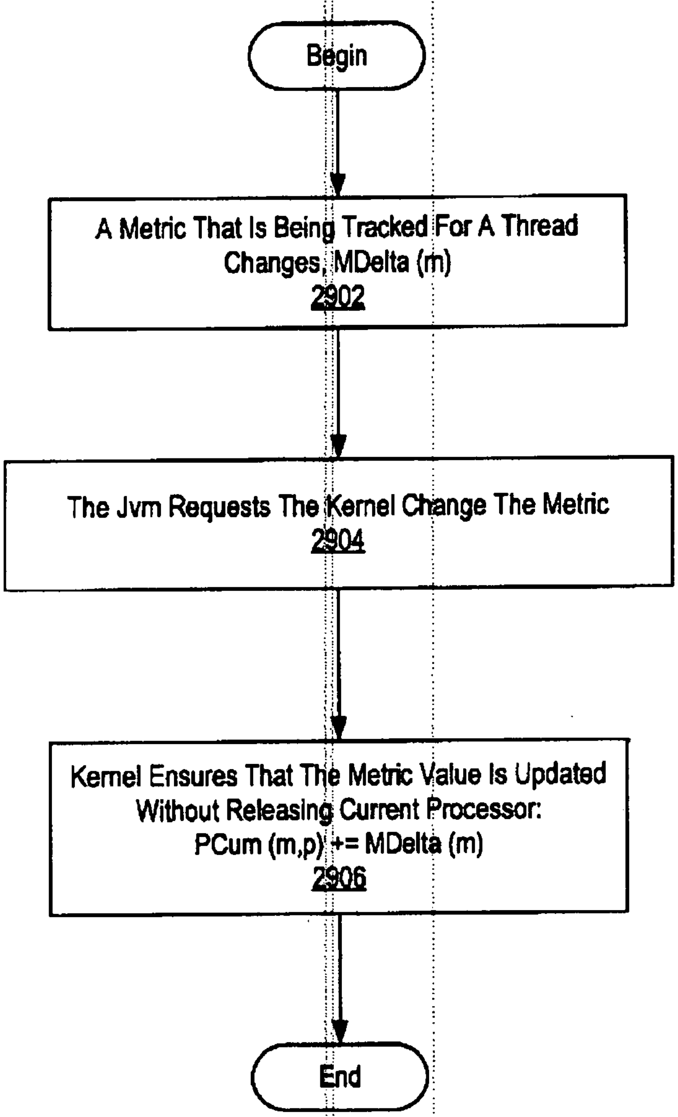
## Process for the Jvm Directly Updating Per Processor Global Variable Values for Metrics Being Tracked



# Figure 29

AUS990853

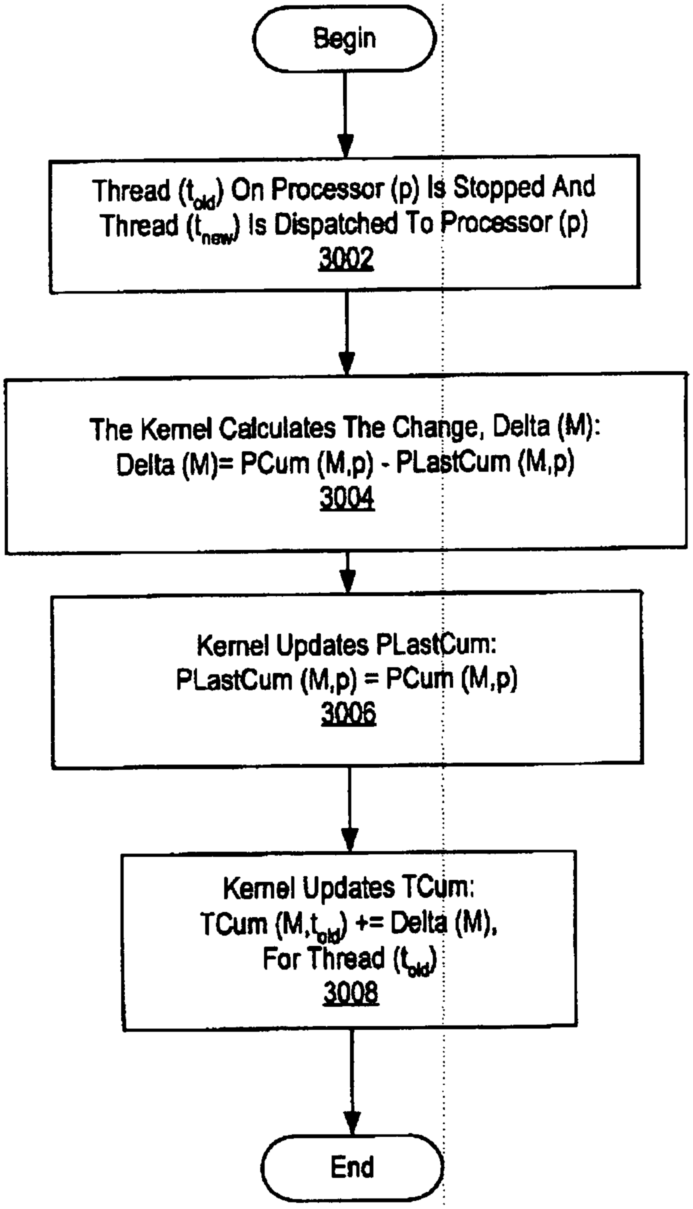
## Process for the OS Kernel Updating Per Processor Global Variable Values for Metrics Being Tracked



# Figure 30

AUS990853

## Process for the Kernel Updating Base Metric Variable Values for Metrics Being Tracked in Response to a Thread Dispatch Event



# Figure 31

AUS990853

## Process for the Profiler Updating Base Metric Variable Values for Metrics Being Tracked in Response to a Method Entry or Exit Event